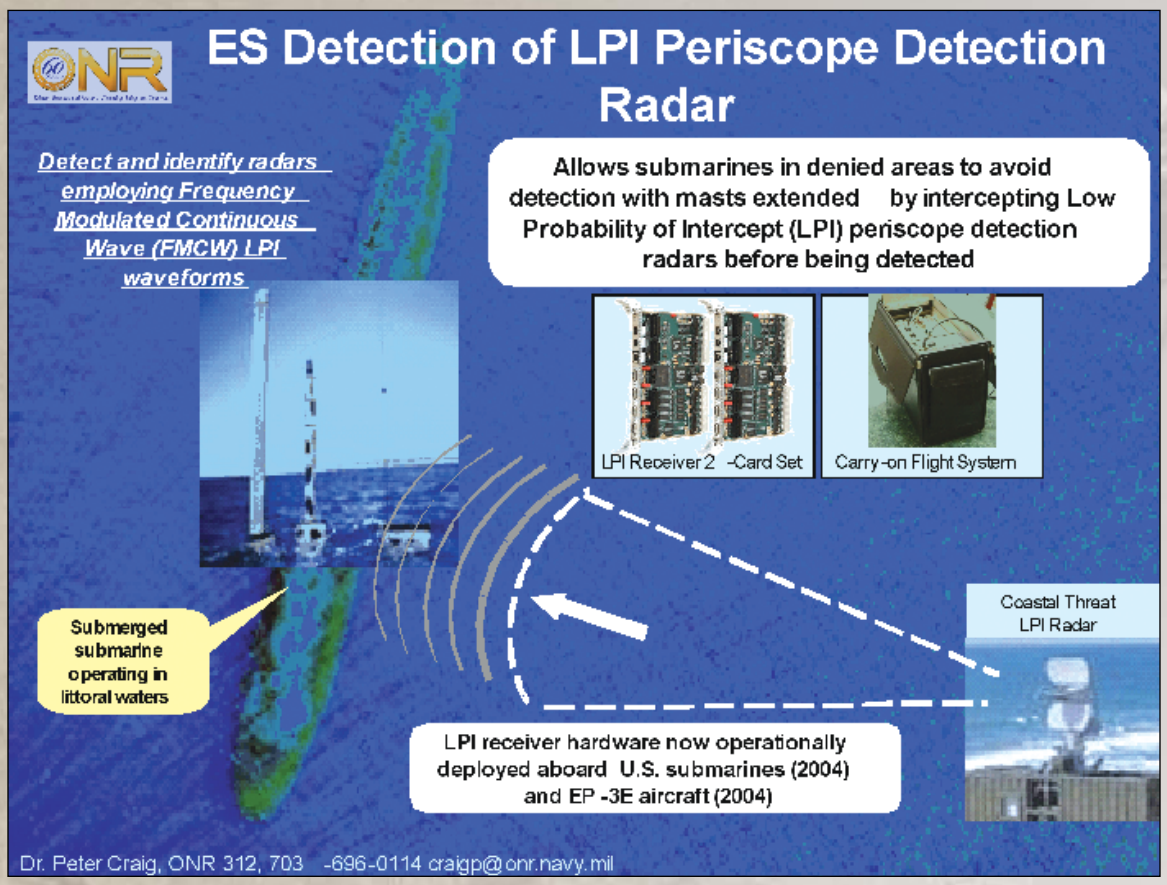
Detection and Identification of LPI and Advanced-Waveform Radio Frequency Emitters

Background: The objective of this DTO was to develop and demonstrate receiver and signal processing techniques suitable for detection and identification of low probability of intercept (LPI) and advanced-waveform radio frequency (RF) signals used in modern RF emitters such as radars and communication systems. This Electronic Support Measure (ESM) RF signal detection capability will enhance threat warning and situational awareness, particularly for the survivability of submarines in hostile threat environments. Two specific classes of LPI radar signals addressed were the frequency-modulated continuous wave (FMCW) and advanced phase-coded classes. The proliferation of LPI radars poses a significant threat to a submarine's ability to operate undetected, especially in the littorals. LPI radars manage their radiated power using techniques such as ultra-wide bandwidth and frequency modulation to improve resolution and deny detection by ESM systems. Existing ESM systems designed to operate against narrowband emitters with high peak power levels have limited capability against LPI emitters. Development of digital receiver and digital processing techniques was emphasized to optimize detection within a low-signal-to-noise-ratio, high-clutter environment.

Success: Over-water testing of an LPI detection system verified that the ES detection range exceeded the radar detection range significantly. Technology development provided ES receivers the capability to detect low-power, swept-frequency radars to which they were previously insensitive. In 2005, the LPI hardware was integrated with a submarine AN/BLQ-10 ES system and successfully tested against an FMCW radar. The Naval Research Laboratory LPI Team developed, tested, and deployed this new capability that provides detection and classification of LPI radar signals. This capability uses commercial off-the-shelf hardware and is easily incorporated into the existing submarine EW system using software that runs on almost any ESM processor. The result was the integration into the existing submarine ESM system with minimal impact and cost. The success of these LPI-developed detection subsystems for ES receivers has led to great interest for deployment on other platforms by the Air Force and the Army.

Year: FY 2006



Detection of LPI Radars beyond the radar's detection range